There are some new varieties; other varieties reduced to forms; and others wholly omitted.

In the letter communicating the above list of Andropogons (dated June 10), Professor Hackel says: "As to other Andropogoneæ, there are some changes in nomenclature, viz.: Imperata brevifolia Vasey is I. Hookeri Rupr.: 'Elionurus candidus' from Texas and Arizona is not E. candidus Hackel in Flor. Brazil., but a new species named E. barbiculmis: 'Elionurus Nuttallianus' of Vasey, Grasses of the U. S., is the type of E. tripsacoides HBK.: Rottbœllia corrugata Baldw. is recognized as a species, with the variety areolata: R. tesselata Steud. is a form of R. corrugata: R. rugosa has a var. Chapmani (Curtiss, no. 3622)."

Washington, D. C.

Notes on the inflorescence of Callitriche.[1]

JOSEPH SCHRENK.

While examining the flowers of *Callitriche heterophylla* Pursh, I noticed some peculiarities about the so-called *bracts* of the inflorescence which seem to have escaped notice thus far.

For the sake of completeness I will briefly state that the species examined has dense floating tufts of broadly spatulate opposite leaves, each bearing in its axil one, sometimes two pistils, and one stamen[2] between a pair of the bracts mentioned. The latter are of a semilunar shape, attached by one of the attenuated ends to the stem, the concave sides turned toward the pistil.

Of such bracts, including those met with in other families, Hydrilleæ, Naiadeæ, Potameæ, etc., H. Schenck, in his elaborate paper on the "Comparative anatomy of submersed plants,"[3] says: "These structures are no stipules, as Caspary calls them, but true trichomes. They are found in the axils of the leaves in the form of tender, transparent, roundish or elongated, small scales, consisting of one or two layers of cells. They originate early at the apex of the stem, develop more rapidly, and perish sooner than the neighboring leaves. Probably they all produce a secretion which en-

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[1] Read before Section F, A. A. A. S., August 16, 1888.

[2] In the numerous specimens examined I noticed that when there were two pistils in one axil the stamen was invariably wanting.

[3] Bibl. bot., Vol. I, 1887, p. 10.—The "Monograph on the genus *Callitriche*," by Fr. Hegelmaier (1864) I was unable to consult, and had to be satisfied with the statements of Schenck (l. c.) and de Bary (Comp. Anat.) referring to it.

velops the growing apex." This paragraph refers to the following passage on the preceding page: "Most likely this secretion protects the meristematic apex and the young leaf buds against parasites, etc., but for the present we can not insist on the correctness of this explanation."

A close inspection of the structures in question will show that they are not simple scales or trichomes, but small bladders or sacs. When held under a lens, in air, they might easily be mistaken for flat scales, but when examined with a low power in the fresh condition, under water, they are invariably found to be filled with air, and thus they can be recognized as bladders without difficulty. That the air is really inside the sacs can also be readily demonstrated by gently warming the water on the slide on which they are placed, when they will be seen to expand considerably. When the sacs are placed in boiling water, the air is at last driven out. This is, in fact, the most convenient way to get rid of the air, for even after long continued treatment in alcohol air bubbles will still remain in the sacs.

Under higher powers the surface view and sections of the bladders show that their wall is a thin membrane formed of a single layer of transparent, elongated, flat cells with very sinuous side walls. Inside of the bladder a slender thread can be distinguished, which projects from the base into the cavity. It consists of two or three rows of long, wavy cells laterally connected by short branches.

At the meristematic apex of the stem, on the youngest node, the sacs are found as small protuberances alongside the rudimentary pistil. They consist of the epidermis, which bulges out in the angle between leaf and pistil, and covers only a few rounded cells that belong to the meristematic interior of the apex. At the next lower node these excresences are much larger. The epidermis cells still have a rounded outline, while the few enclosed cells begin to elongate perceptibly. Examining still older nodes we find that the development of the sacs has been completed. The cells of its wall have increased rapidly in number and size, and have assumed the wavy outline peculiar to so many epidermis cells. The growth of the cells which originally filled the sac has not kept pace with its surface growth, and they have remained as a contorted and isolated thread in the interior of the sac, while the walls have receded and expanded.

Thus a hollow plant organ is formed by schizogenetic

growth, which it is impossible to designate a "trichome," for it is evidently not merely an outgrowth of the epidermis. On thin longitudinal sections the continuity of the air-spaces in the larger air-channels of the internode, in the intercellular cavities of the node, and, finally, in the interior of the sacs, can be traced distinctly. I would, therefore, call these sacs, not trichomes, but reduced, or rather transformed phyllomes, transformed in order to fulfil a special function, *i. e.*, to give the apex of the stem necessary buoyancy, so that the leaves may receive light and air, and the pistils and stamens the visits of insects or the currents of the air.

At no stage could any secretion exuding from the sacs be noticed. The protoplasm contained in the cells, although plainly visible at the early stages, is too insignificant to indicate that intense activity which is going on in secretory organs; besides, the comparative isolation of the cells, which are really simply epidermis cells, speaks against such a function. But I would call attention to the peculiar fan-shaped, or rather palm-shaped hairs[4] found at the nodes in considerable numbers, which most likely produce some kind of secretion. Their walls are filled with dense, granular protoplasm, and are quite thick, presenting on the addition of reagents the peculiar appearance of mucilage-producing membranes. Besides, the fact that they are found fully developed at the very apex of the growing stem, when all the other organs, the sacs included, just begin to differentiate, leaves hardly any doubt that they serve for the protection of those points that are most in need of it.

For systematic botany the question is of great interest, whether each, the pistil and the stamen of Callitriche, is to be considered a separate flower or not. In most text-books[5] the flowers are described as monœcious. In my opinion, the histology of the inflorescence ought to decide the question.

On a longitudinal median section of the stem, through a young node, we see a central fibro-vascular bundle which receives additional strands of vessels on both sides from the leaves. In each of the two angles thus formed there arises a vascular bundle which, after proceeding a short distance, separates into two slender branches; one of them, the one nearer to the leaf, leads to the pistil, and the other, the upper

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[4]Cf. DeBary, Comp. Anat. Engl. ed., p. 64.

[5]*e. g.*, Gray's Manual, Eichler's Syllabus.

one, to the stamen. The other tissues of pistil and stamen are arranged correspondingly, so that, *e. g.*, the epidermis of the filament and of the short pedicel of the pistil are a continuous layer of cells.

There is no reason why, under these circumstances, we should separate these two organs and call them two different flowers, when, in fact, they could not be any more closely connected than they really are.

Hoboken, N. J.

Undescribed plants from Guatemala. V.

JOHN DONNELL SMITH.

(WITH PLATES XXIII and XXIV.)

VOCHYSIA GUATEMALENSIS. Bot. Gazette, XII, 131. Explanation of Plate XXIII: Fig. 1. Flowering branch—natural size. Fig. 2. Immature capsule. Fig. 3. Flower. Fig. 4. Same with pistil exposed. Fig. 5. Staminode. Fig. 6. Stamen. Fig. 7. Anterior petal. Fig. 8. One of the lateral petals. Fig. 9. Vertical section of ovary. Fig. 10. Ovule. Fig. 11. Diagram of flower. (Figs. 3–11 are variously enlarged.)

Hanburia parviflora.—Leaves roundish, base emarginate, 5–6 inches long, 5-times exceeding petiole, triplinerved, tripartite nearly to base, divisions oblong-lanceolate: shortly peduncled racemes 12–15-flowered, flexuose, nodding, twice exceeding petioles, spreading pedicels equalling flowers: calyx urceolate-campanulate, 6 lines long, nearly half as broad, teeth minute: corolla-segments ovate, half as long as calyx, reflexed: filament-column 4 lines long, antheriferous globose-turbinate head 2 lines broad, cells in 10–12 pairs: pistillate flowers not seen.—The other species of this genus, *H. Mexicana* Seem., has long-petioled uniformly undivided leaves exceeded by peduncles of rigid racemes, sparse twice-larger flowers, a shortly campanulate calyx, anther-cells in more numerous lines.—Pansamalà, alt. 3,800 feet, April, 1888. (Ex Pl. Guat. Tuerckh., qu. edid. J. D. S., 1366.)

Calea trichotoma.—Branches divaricate, fusco-tomentose: leaves petiolate, 12–18 lines long, subcordate, triplinerved, remotely serrulate, scabrid above, cano-tomentose beneath: pedicels of simple or compound terminal corymbs 3, half an